Abstract

In recent years there has been a growing market for more universal analysis instruments. Analysis tools such as AFM[1], TEM[2] and nanoindentation work in similar environments. It is therefore possible, within limits, to use the same equipment to do all of these analyses. Conducting nanoindentation experiments in a TEM has also the advantage of increased accuracy compared to the tests done today.

This project is focused on design and fabrication of a capacitive force sensor for AFM and/or nanoindentation measurements in a TEM. Nanofactory Instruments, the initiator of this project, has developed a specimen holder for TEM that can be used for nanoindentation experiments. The measurement system used today has its limitations of being to large to be mounted in a TEM and thus an improved model was desired.

The idea to combine an AFM and nanoindenter sensor in the same design is however at this stage inhibited by a relatively large diamond tip that was specified for the nanoindentation experiments. The work was therefore concentrated on the design and fabrication of a nanoindenter senor. The design is done with an integrated fixture for a diamond tip with specified dimensions. The sensor design has been manufactured using double-sided lithography, DRIE[3] etch and anodic bonding. The resulting wafer was sawed into components and the components were evaluated.

Evaluation of the sensor shows that it was possible to manufacture a micromachined nanoindenter sensor with an integrated fixture for a standard diamond tip. CV[4]-measurements conducted with HP 4284A indicates a force dependent capacitance change when a force within the specification range is applied. Future work will involve a more detailed characterization using a read-out chip from SmartTec.

[1] Atomic Force Microscopy
[2] Transmission Electron Microscope
[3] Dry Reactive Ion Etch
[4] Capacitance-Voltage measurements